Investigating Jet-Medium Interactions with Two-Particle Correlations in PHENIX

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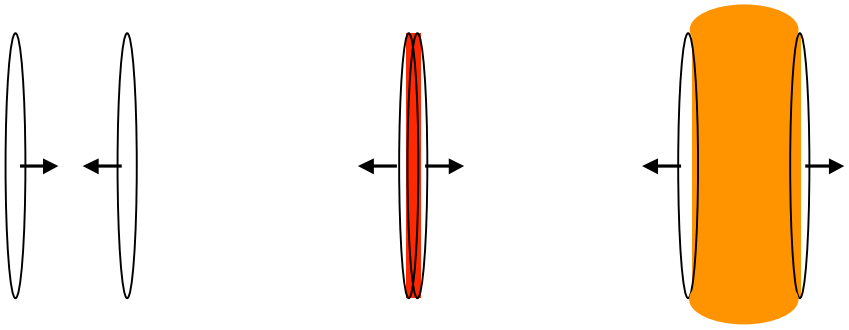
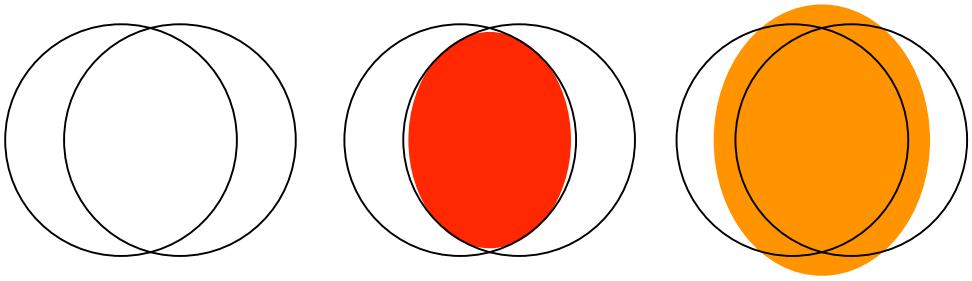
For the PHENIX Collaboration

CIPANP06

Side-to-beam view

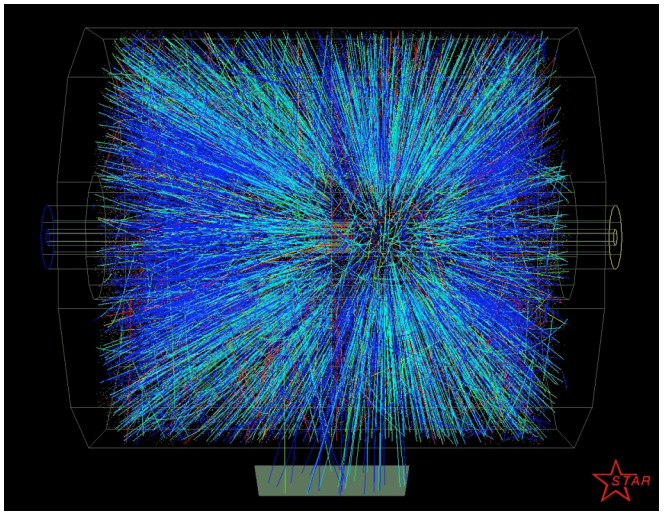


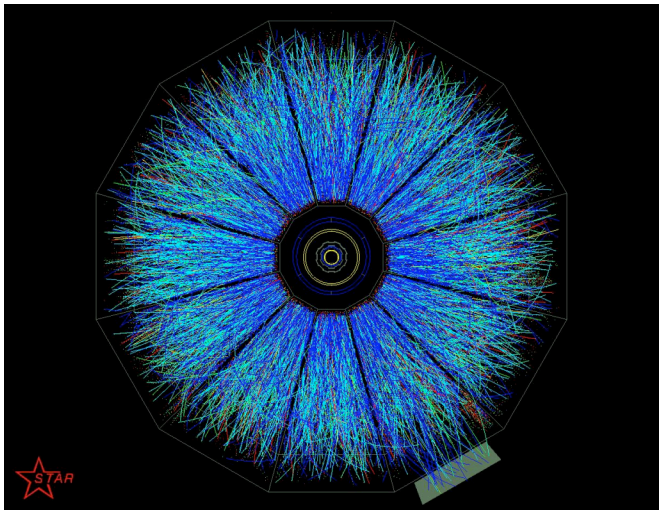
Hot Zone



Along-the-beam view

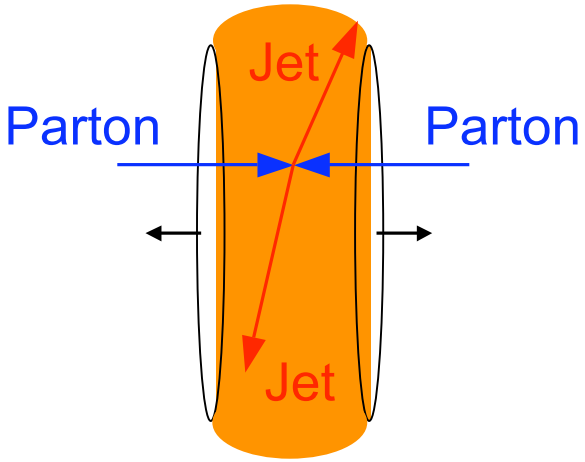
STAR Experiment at RHIC

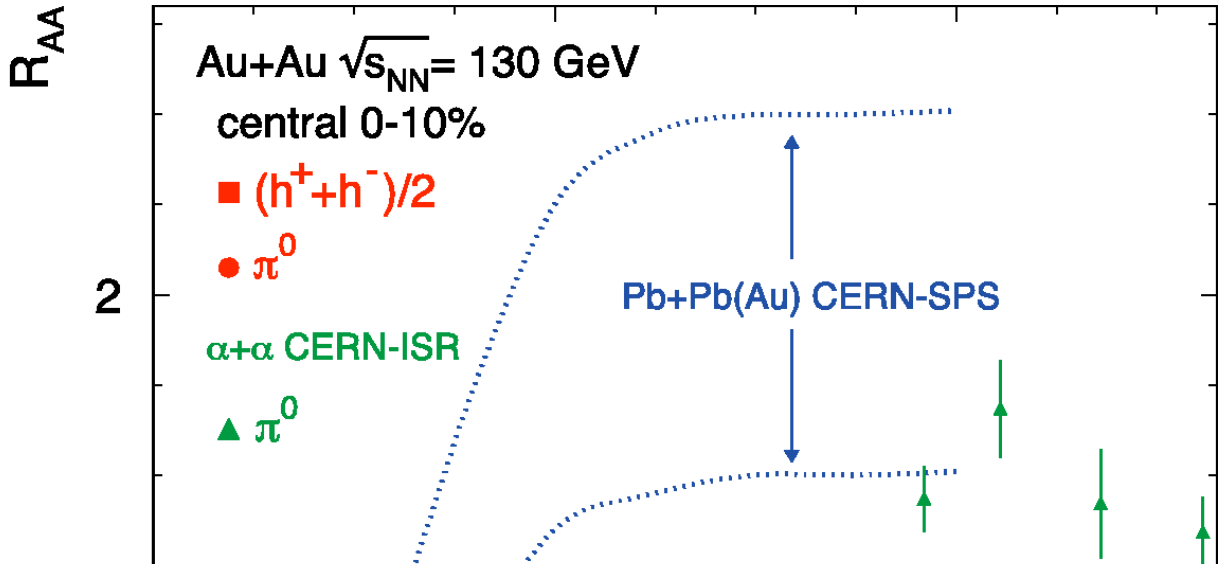




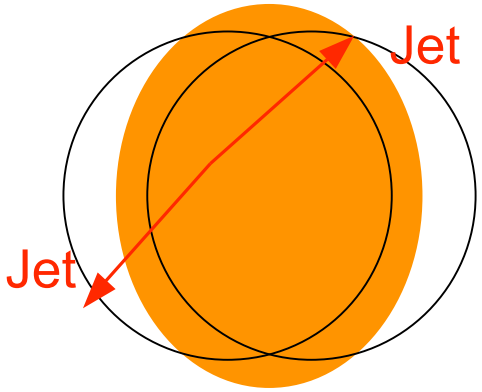
Au+Au at $\sqrt{s_{NN}}$ = 200 GeV

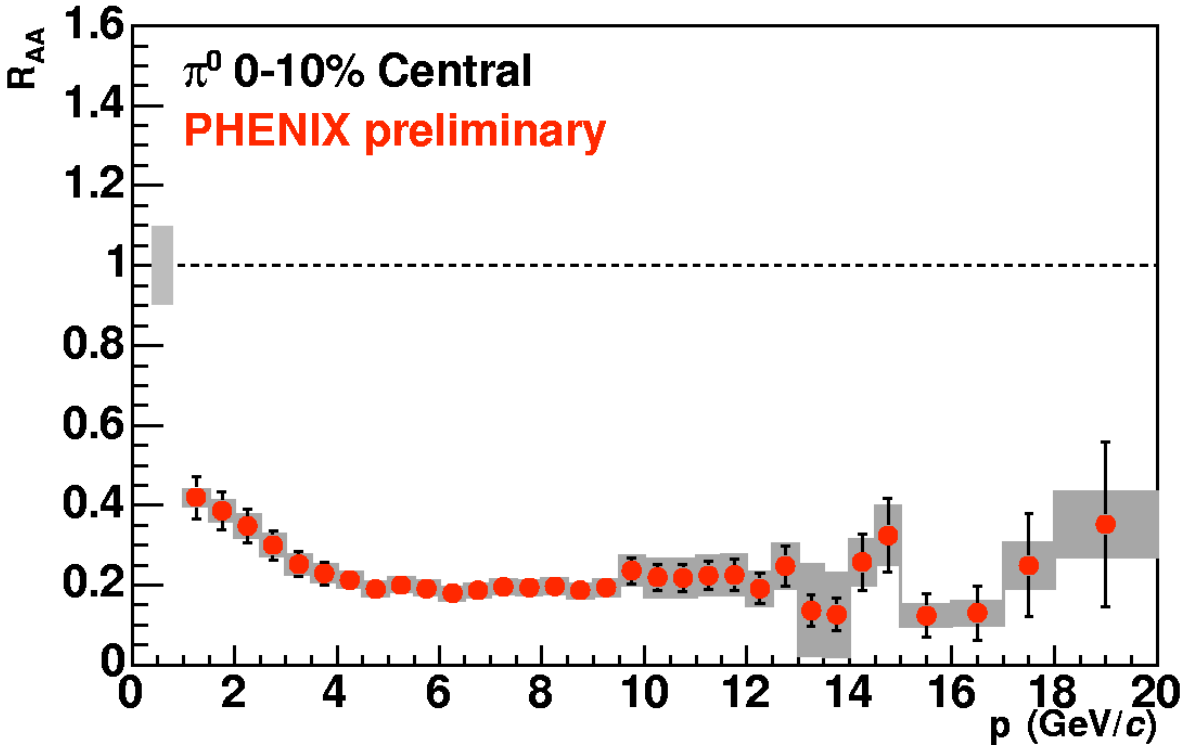
Side-to-beam





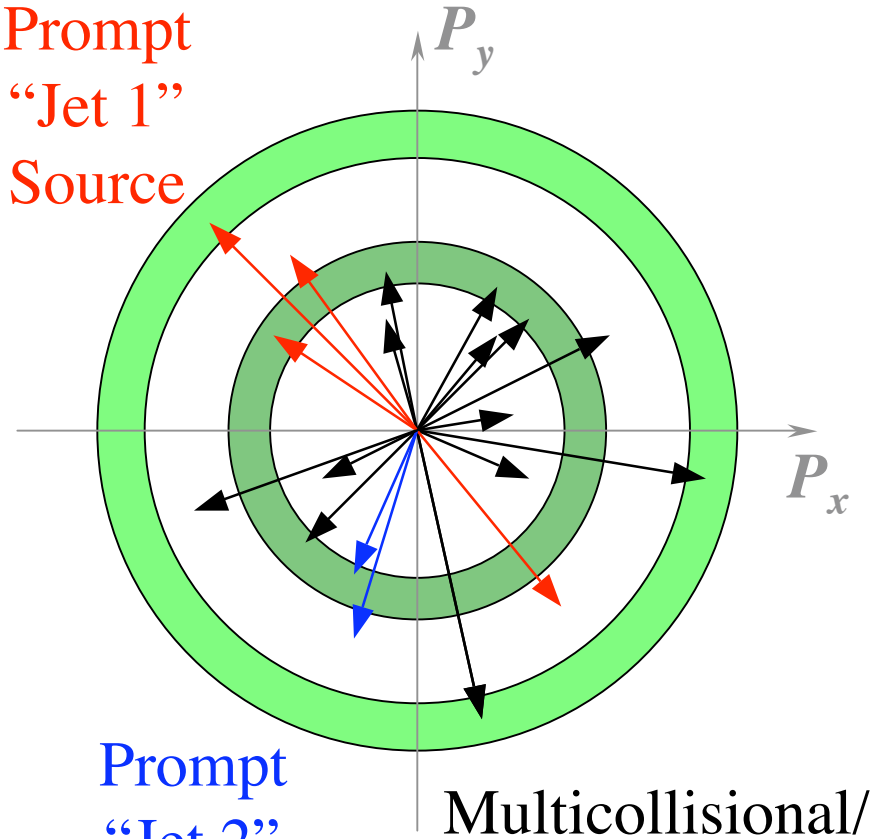
Along-the-beam





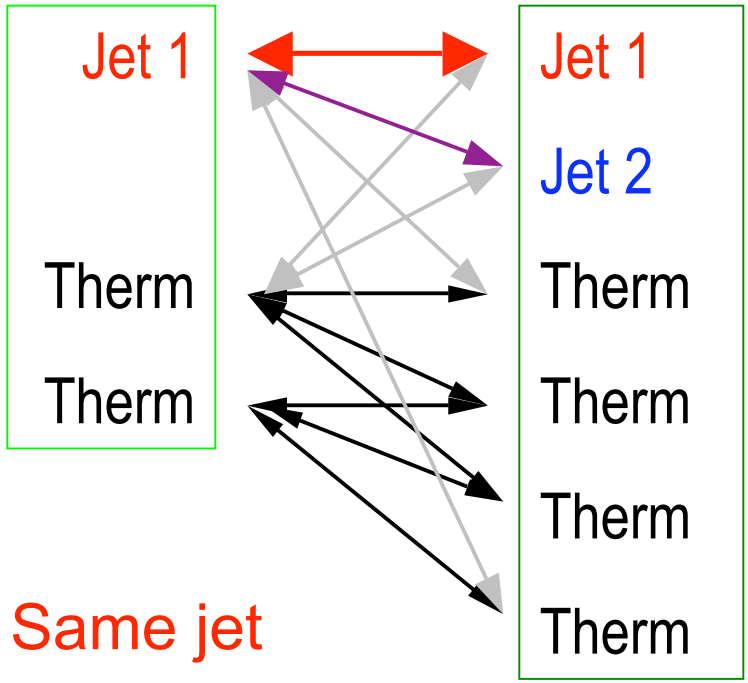
Jet-Medium Interaction?

Two-Source Model



Particles A
from high-p_T
"Trigger" bin

Particles B
from low-p_T
"Partner" bin



Same jet

Unrelated jets

Jet-Thermal

Thermal-Thermal

Singles

$$\frac{dN^A}{d\phi_A} \propto 1 + 2v_2^A \cos 2(\phi_A - \Psi_{\mathrm{RP}}) \quad \text{same for } B$$

Pairs

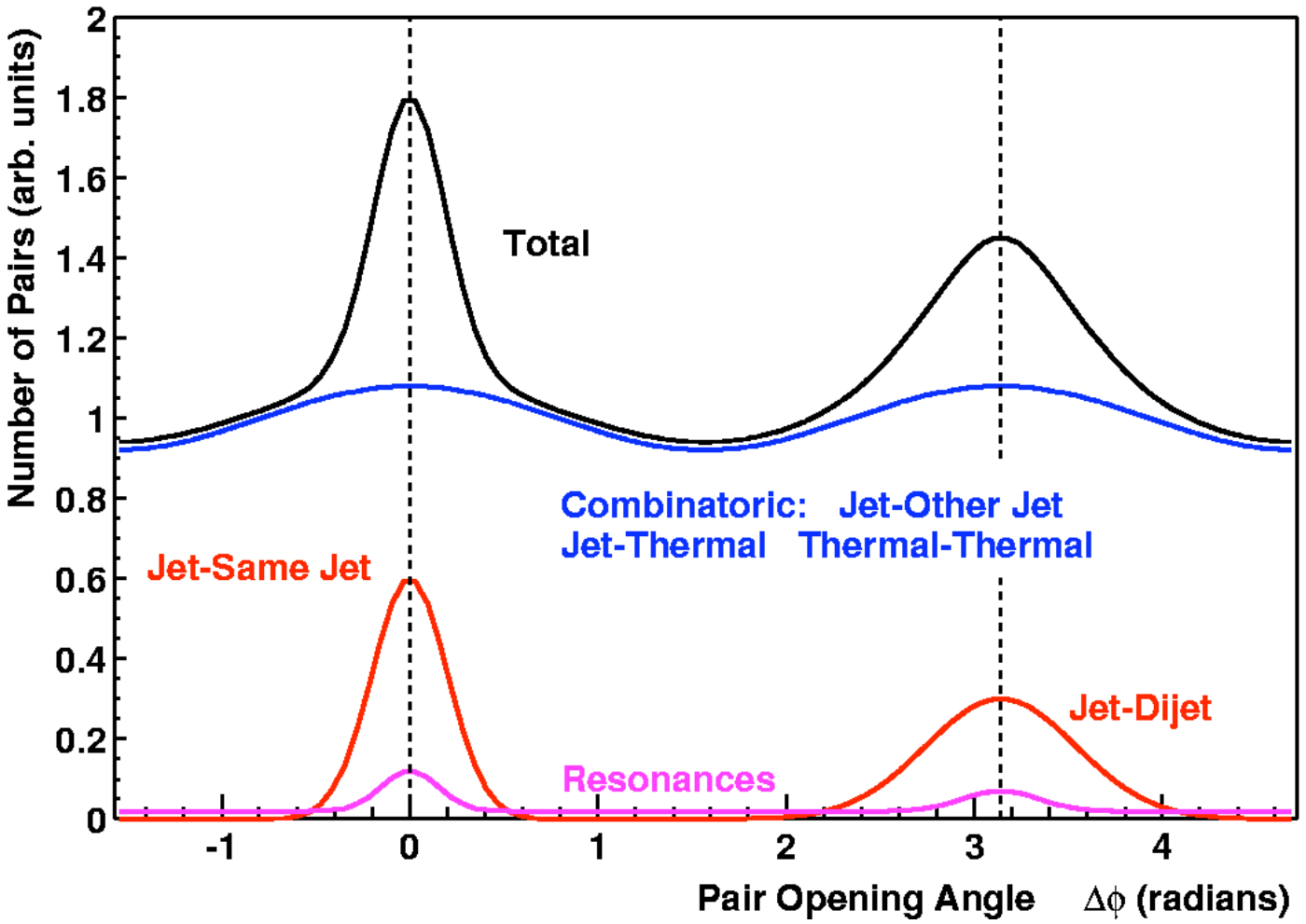
$$\frac{dN^{AB}}{d(\Delta\phi)} = \underbrace{b_0\left[1 + 2\left\langle v_2^A v_2^B \right\rangle \cos(2\Delta\phi)\right]}_{\text{Therm-Therm Jet-Therm Jet-Other Jet}} + \underbrace{J(\Delta\phi)}_{\text{Same-Jet Pairs}}$$

combinatoric "Background Pairs"

b_0 **Background Level** Fix by matching, fitting, combinatoric+

$J(\Delta\phi)$ **Jet-Induced Pairs** Fragmentation and medium response

$$\underbrace{\frac{dN^{AB}}{d(\Delta\phi)}}_{\text{Pairs}} \propto \underbrace{\frac{1}{N_A}\frac{dN^{AB}}{d(\Delta\phi)}}_{\text{Conditional Yield}} \propto \underbrace{\frac{dN^{AB}/d(\Delta\phi)\ \text{same-event}}{dN^{AB}/d(\Delta\phi)\ \text{mixed-event}}}_{\text{Correlation Function}}$$

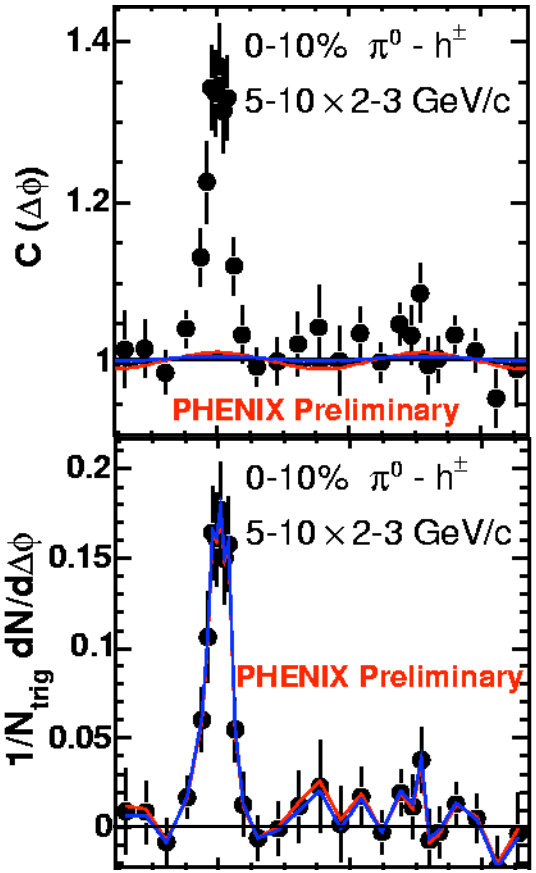


Particle Type	$h^{\pm} - h^{\pm}$	C: 20-40%
Trigger P_T	T: 5-6 GeV	P: 2-3 GeV

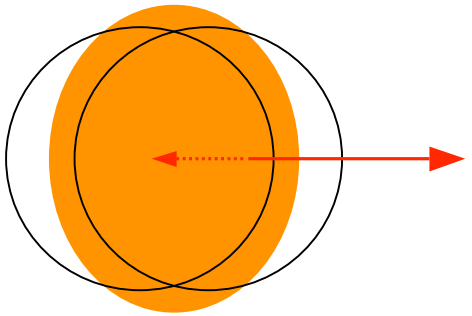
Event Centrality

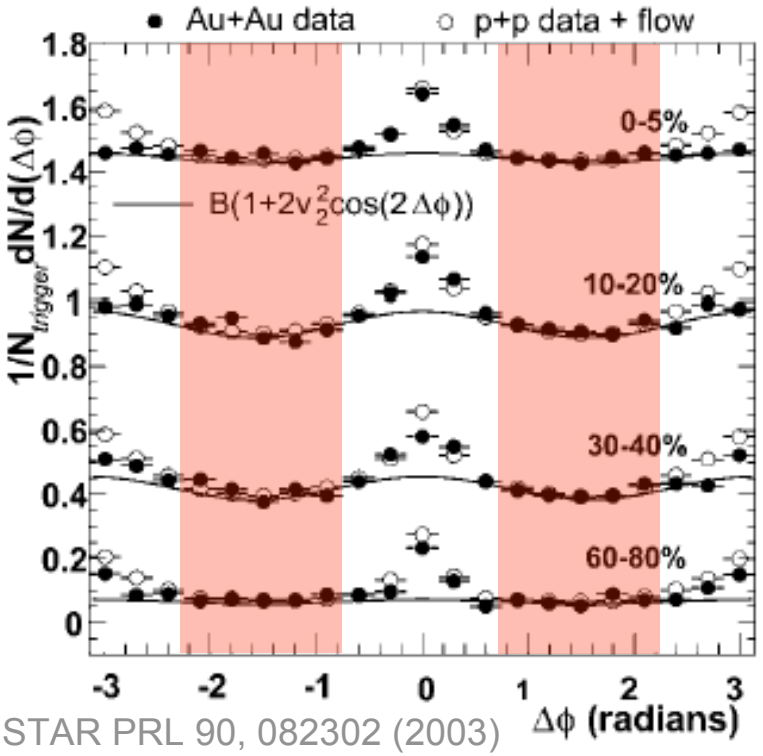
Partner P_T

Away-side Disappearance



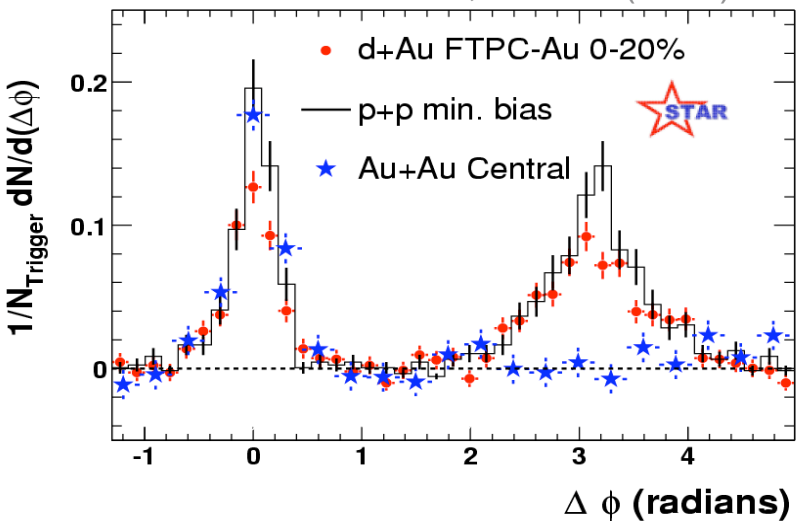
$\pi^0 - h^\pm$	C: 0-10%
T: 5-10	P: 2-3





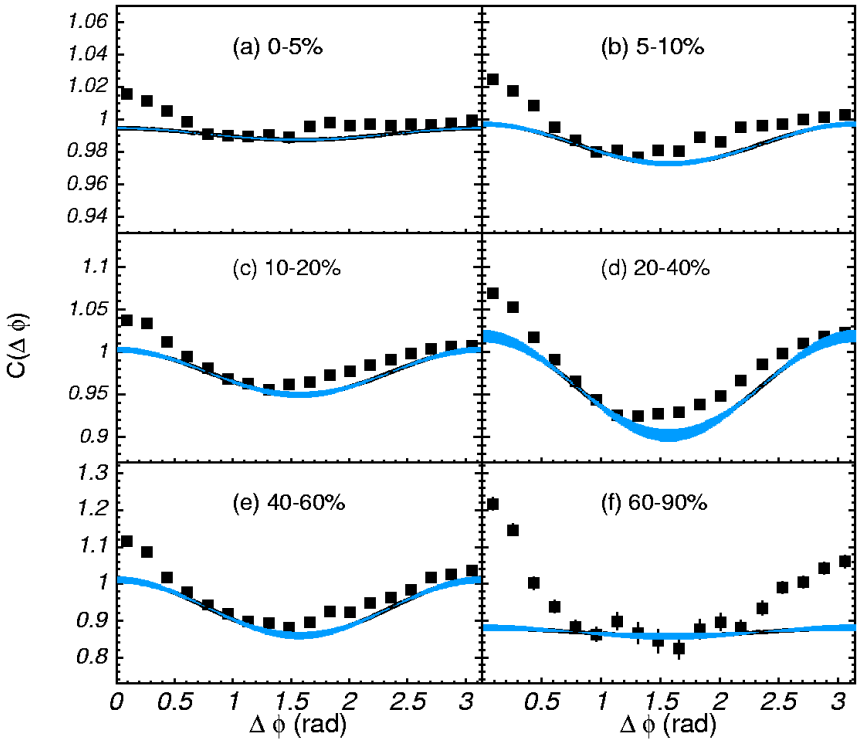
STAR PRL 90, 082302 (2003)

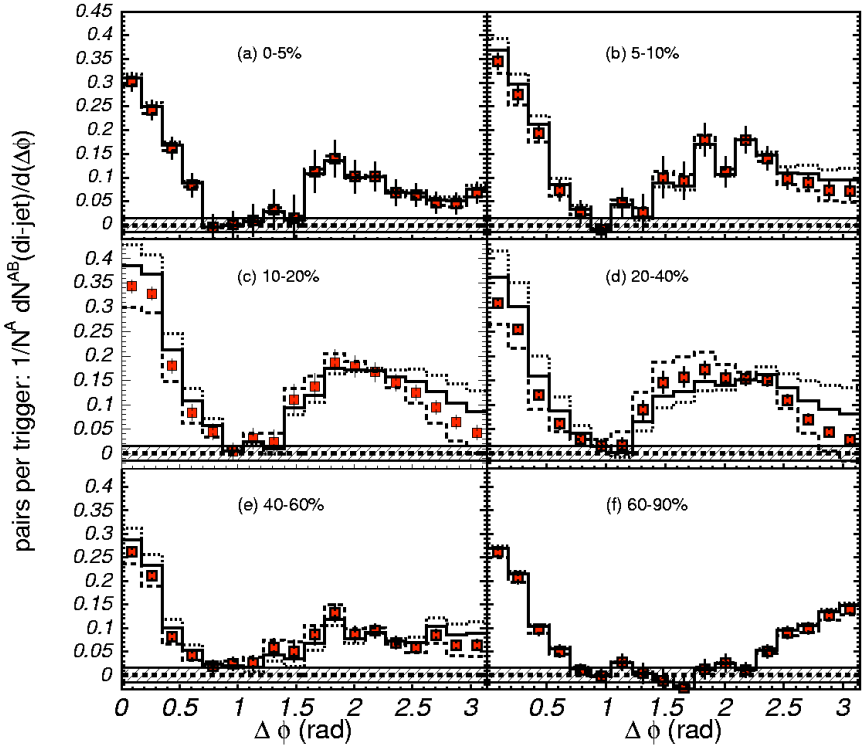
STAR PRL 91, 072304 (2003)



$h^\pm - h^\pm$
C: Various
T: 4-6
P: 2-$P_{T\ Trig}$

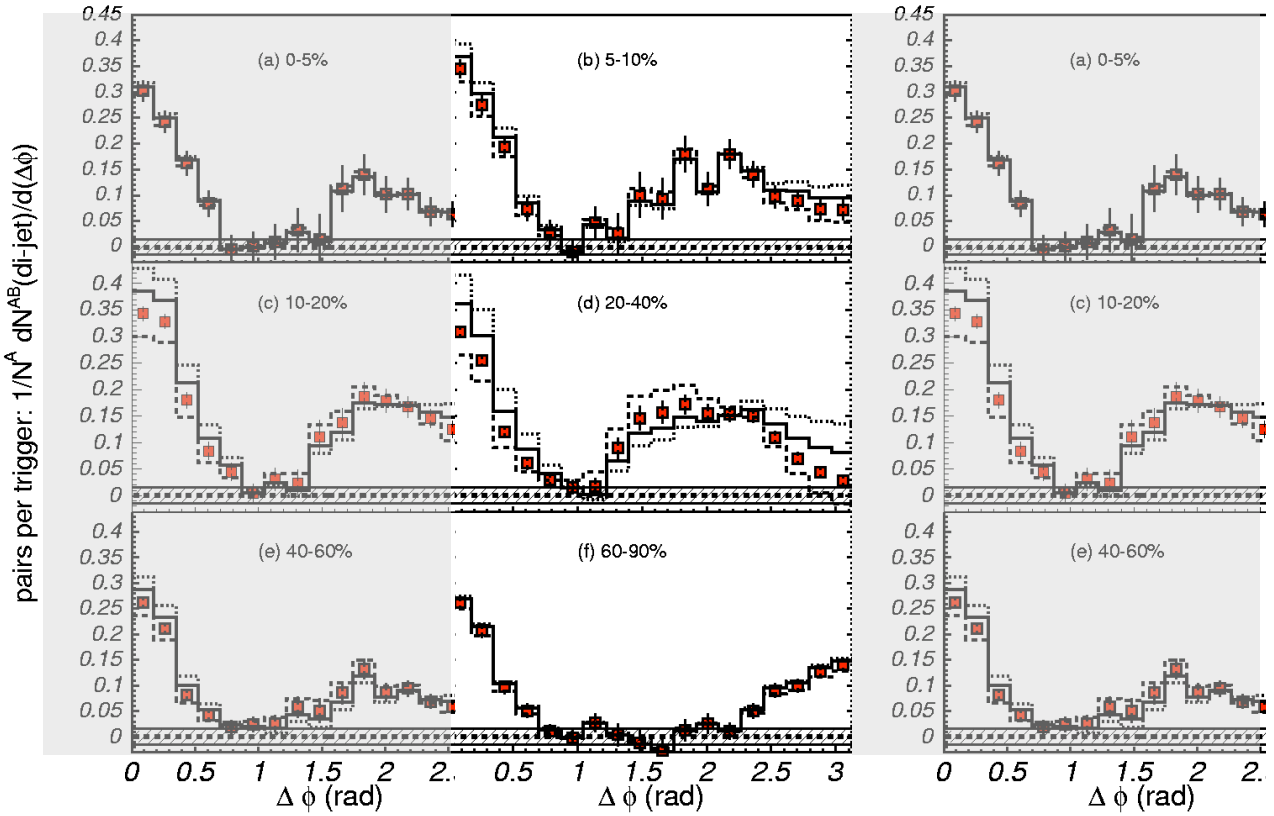
Away-Side Broadening (and how!)





PHENIX nucl-ex/0507004 submitted to PRL

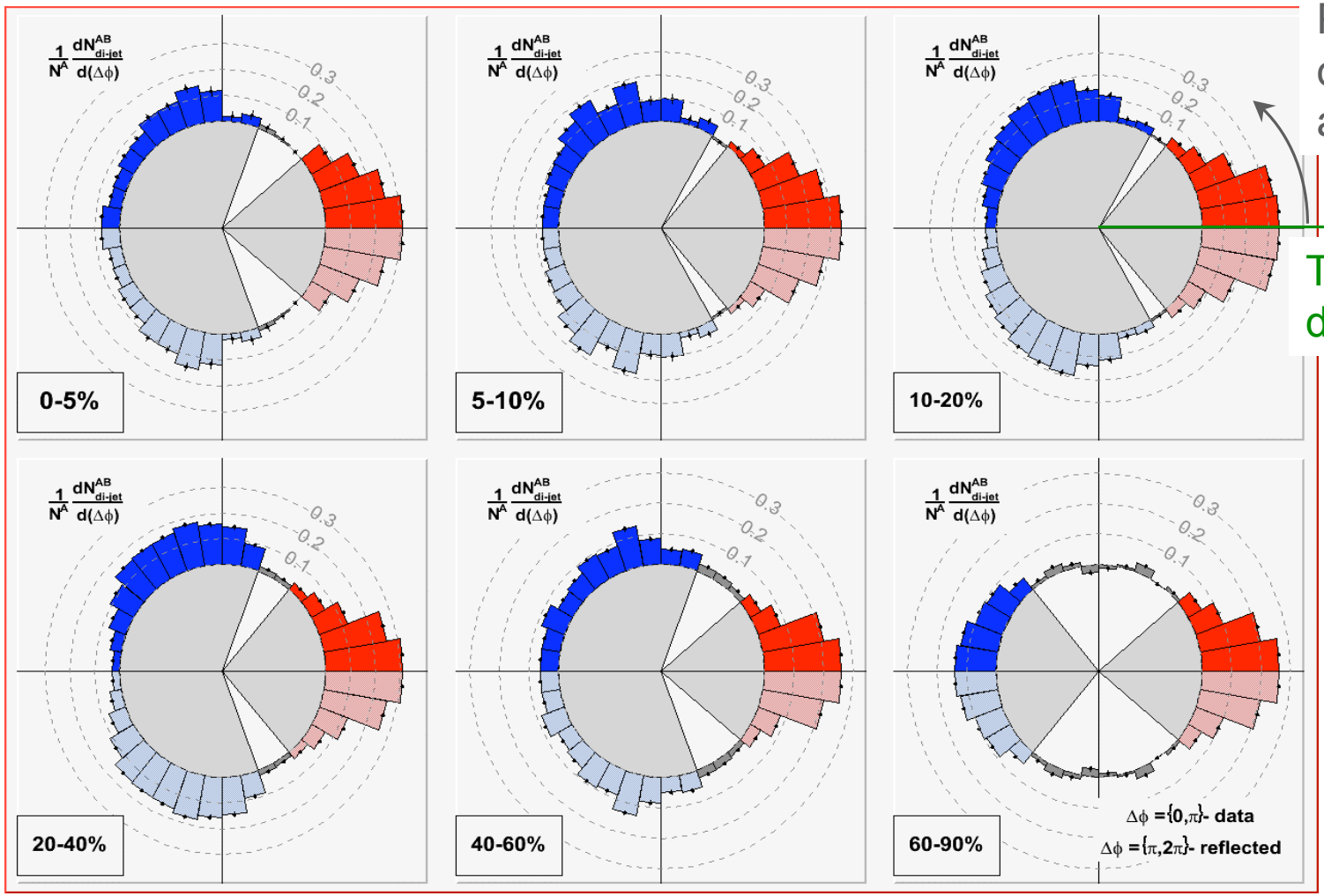
$h^{\pm} - h^{\pm}$	C: Various
T: 2.5 - 4	P: 1 - 2.5



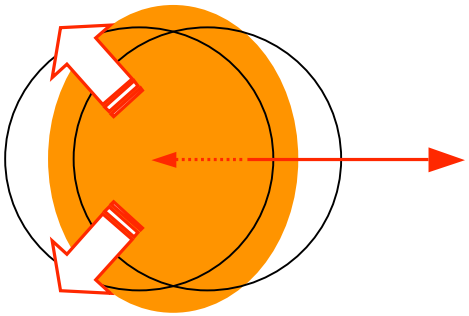
Near-side peak

Away-side plateau (dip?)

$h^{\pm} - h^{\pm}$	C: Various
T: 2.5 - 4	P: 1 - 2.5

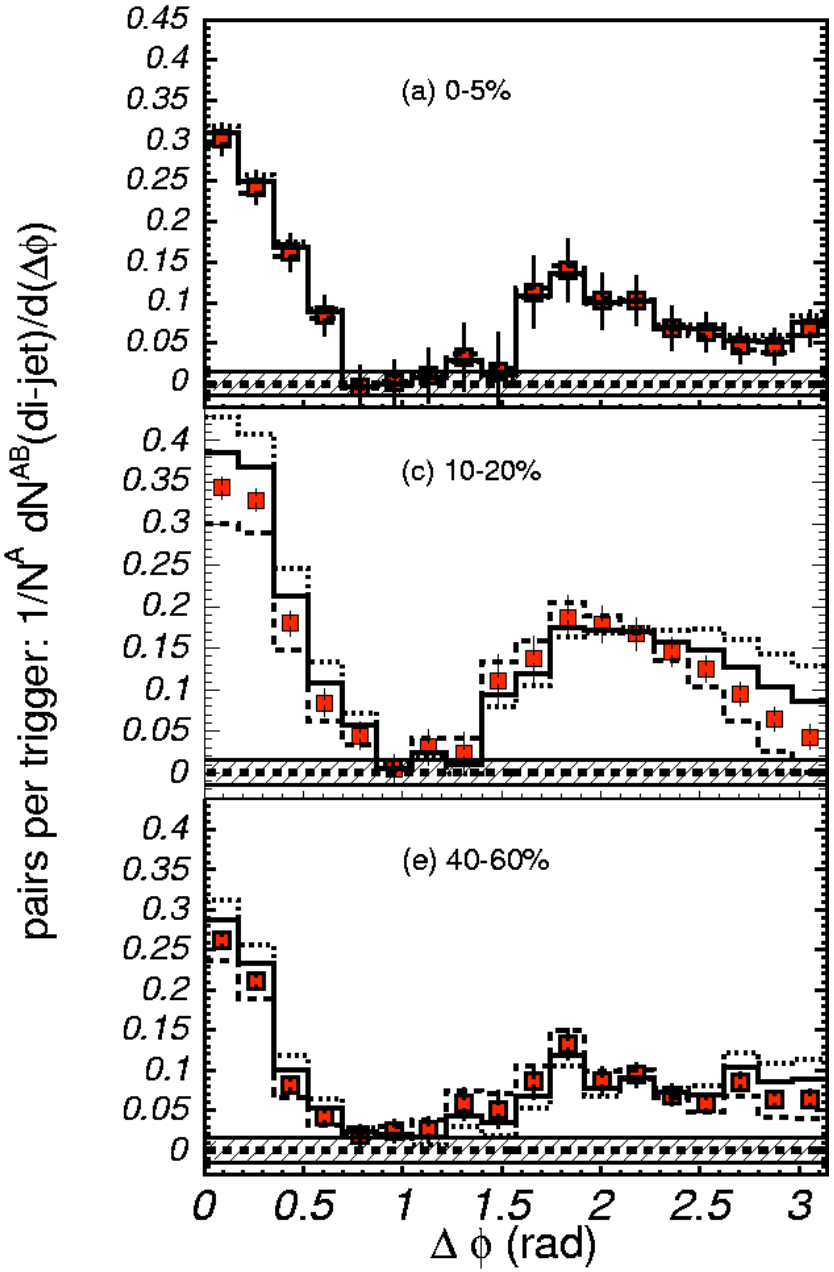


h± – h±
C: Various
T: 2.5 - 4
P: 1 - 2.5



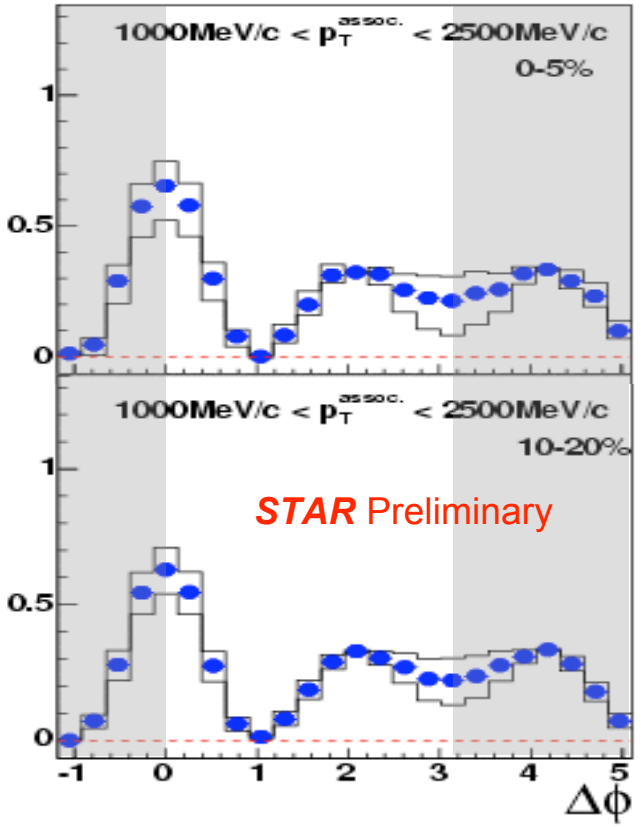
Suggestive of…

Cherenkov cones?
Mach cones?



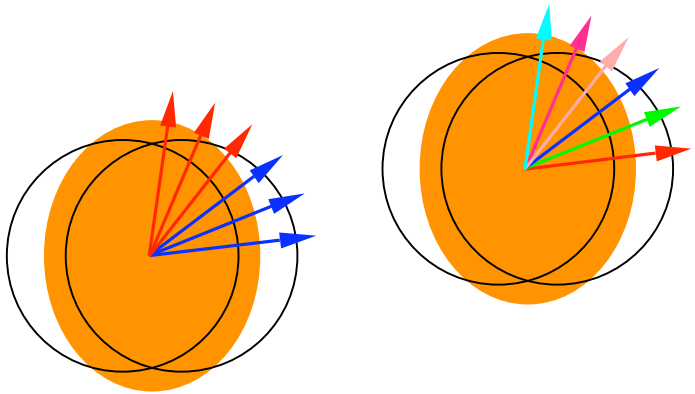
$h^{\pm} - h^{\pm}$
C: 0-5%
T: 2.5 - 4
P: 1 - 2.5

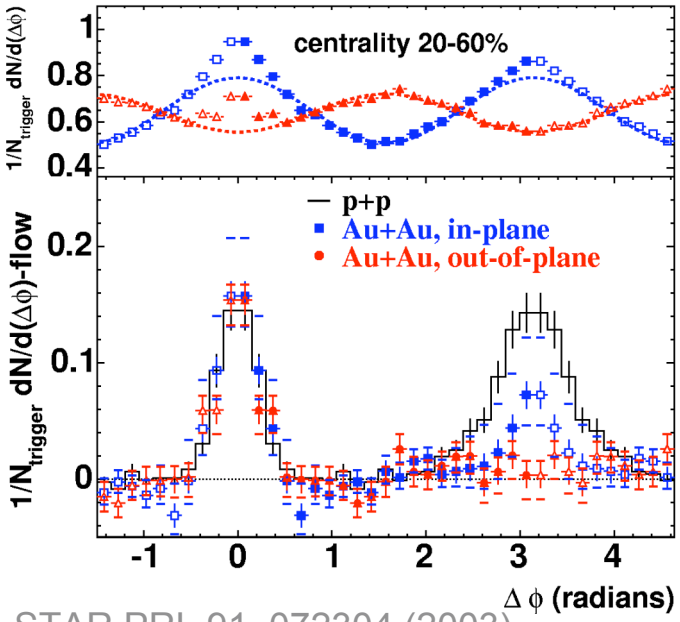
$h^{\pm} - h^{\pm}$
C: 10-20%
T: 2.5 - 4
P: 1 - 2.5



STAR "QM05 Focus" C. Gagliardi

PHENIX nucl-ex/0507004 submitted to PRL





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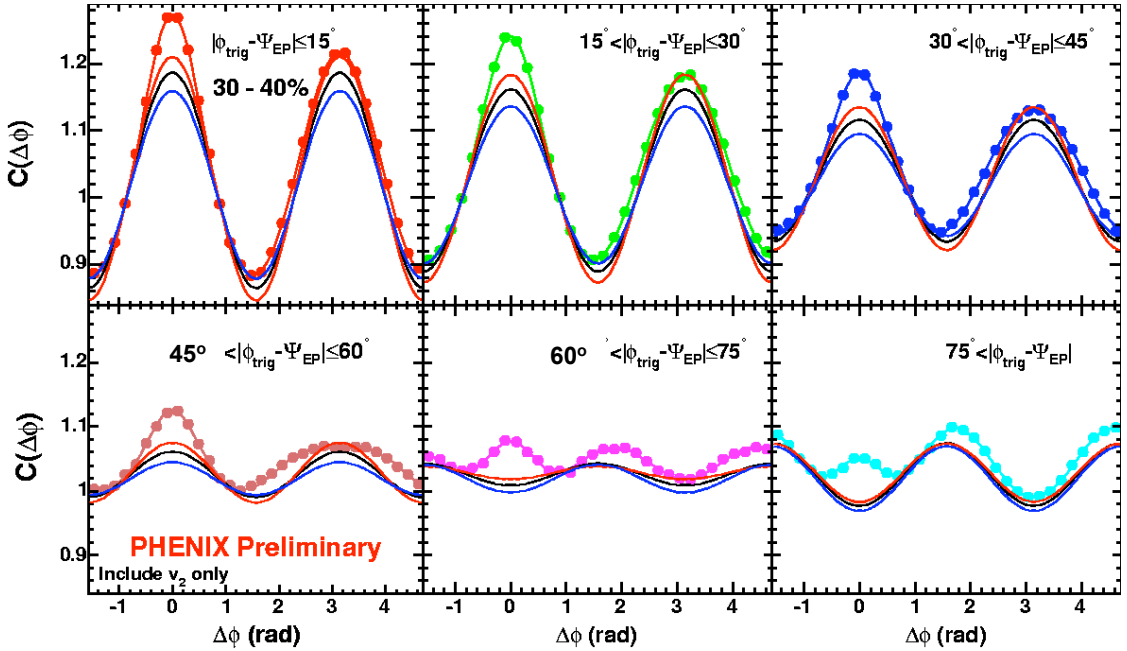
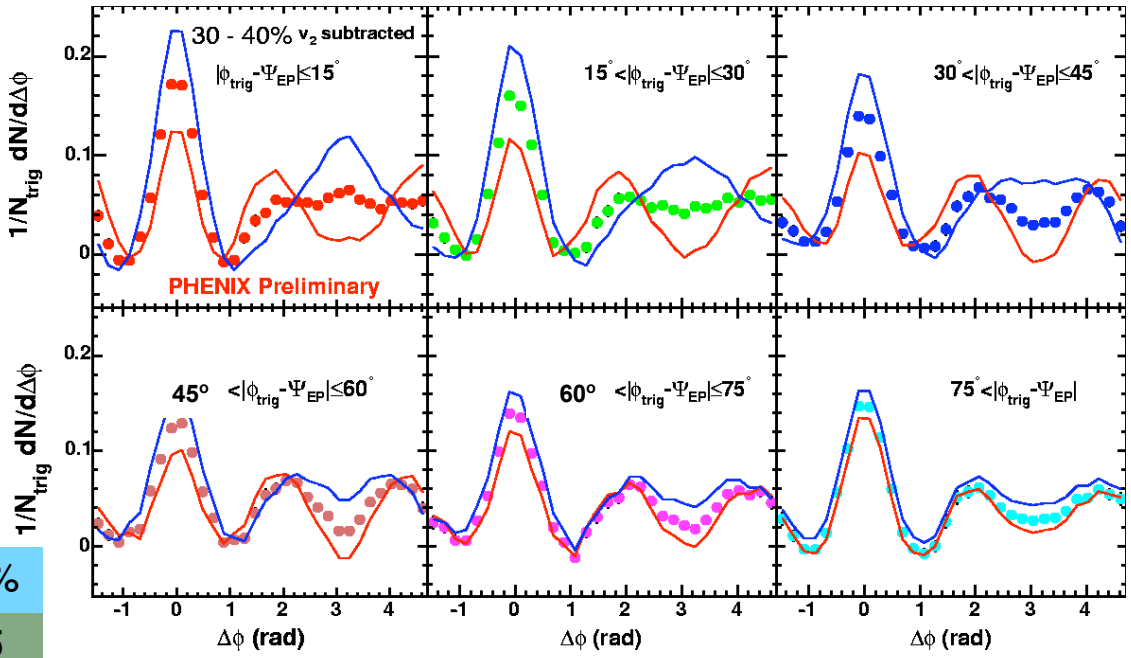




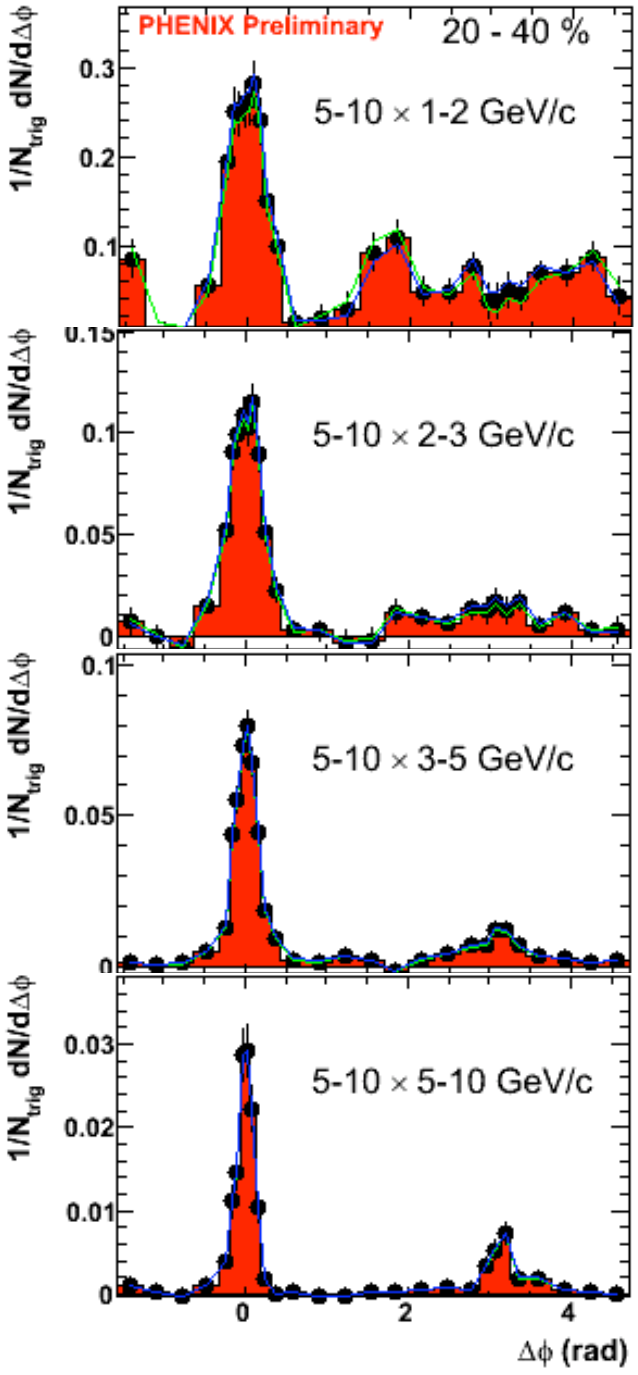
$h^{\pm} - h^{\pm}$
C: 20-60%
T: 4-6
P: 2-$P_{T\ Trig}$

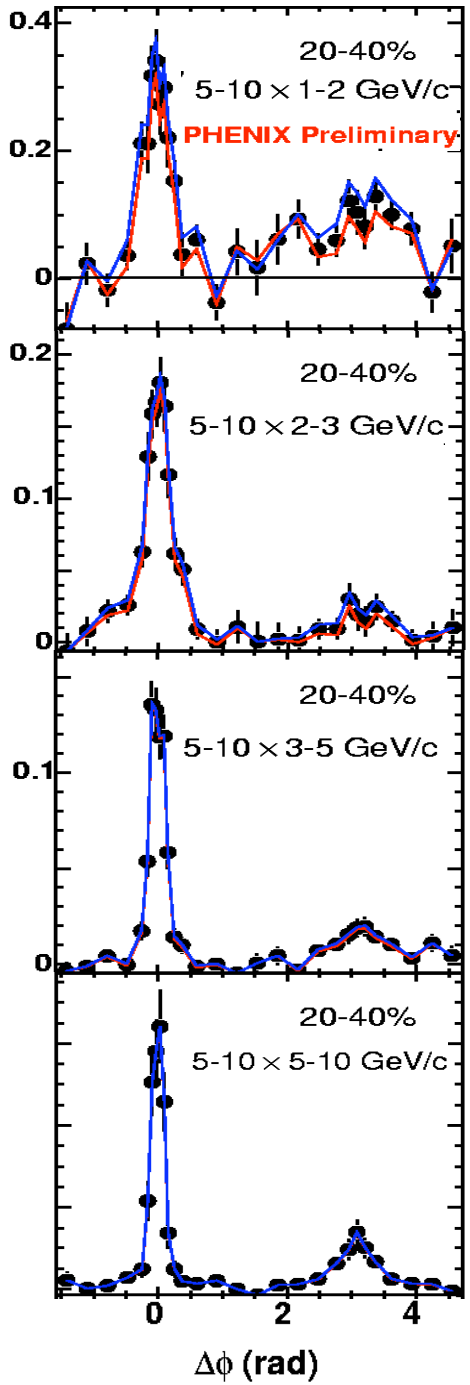
$h^{\pm} - h^{\pm}$	C: 30-40%
T: 2.5 - 4	P: 1 - 2.5

Fix P_T Trig

Raise P_T Part

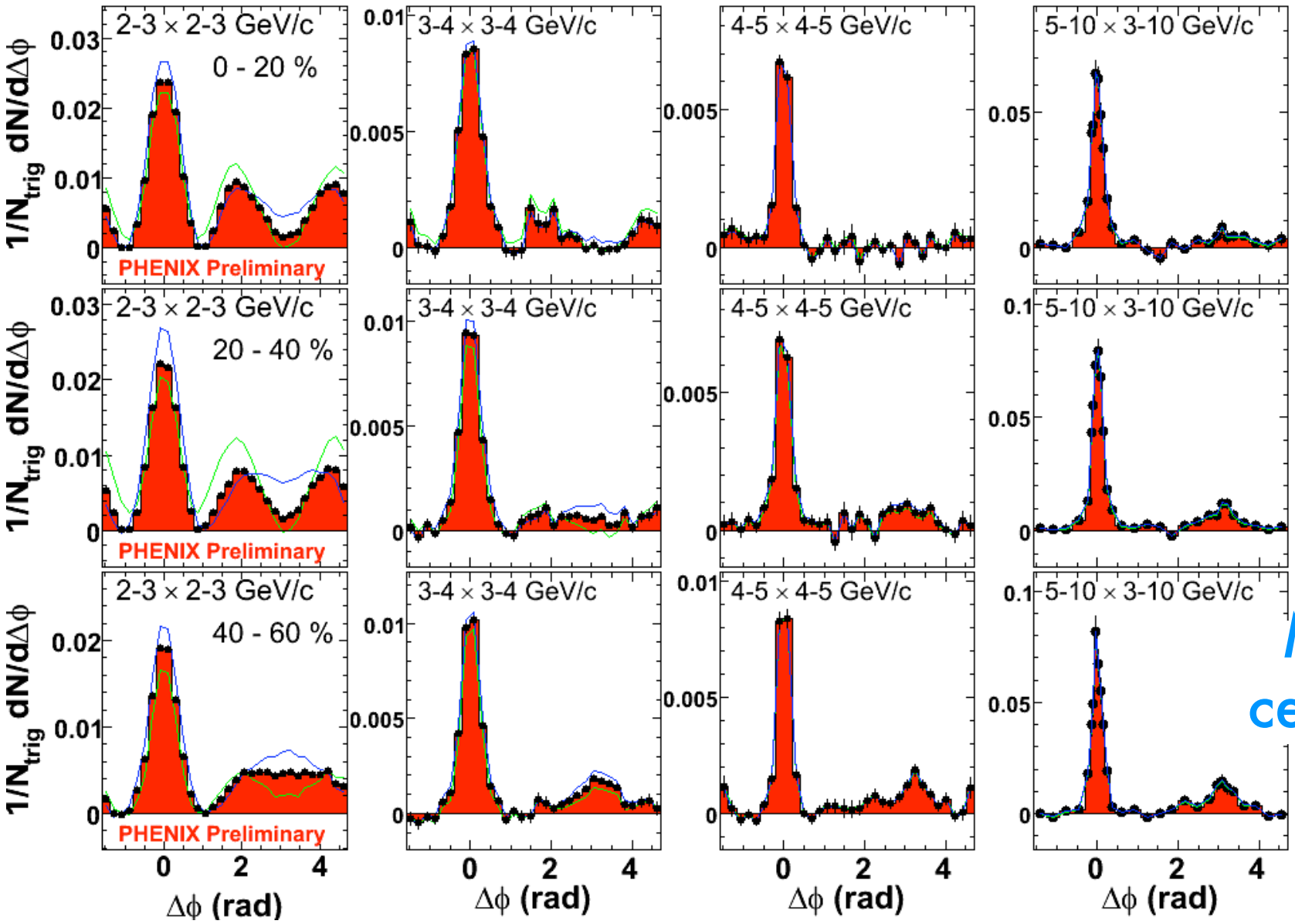
$h^{\pm} - h^{\pm}$
C:20-40%
T: 5-10
P: Various





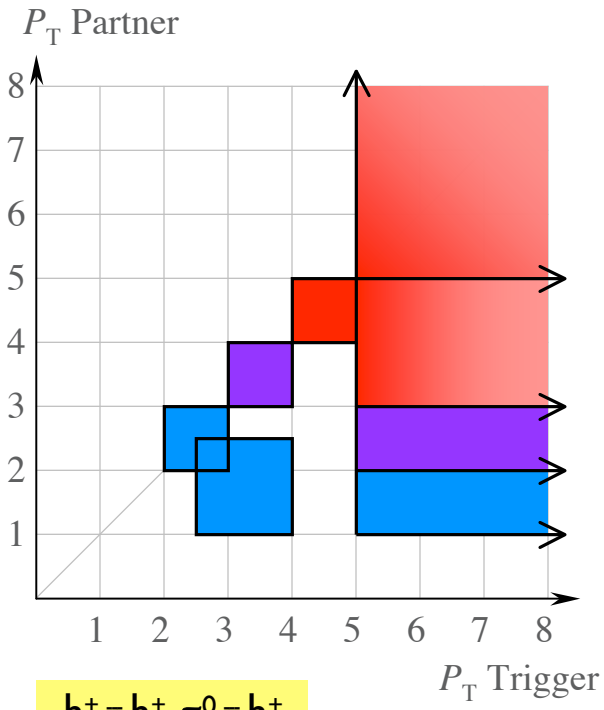
$\pi^0 - h^{\pm}$
C:20-40%
T: 5-10
P: Various

Higher P_T



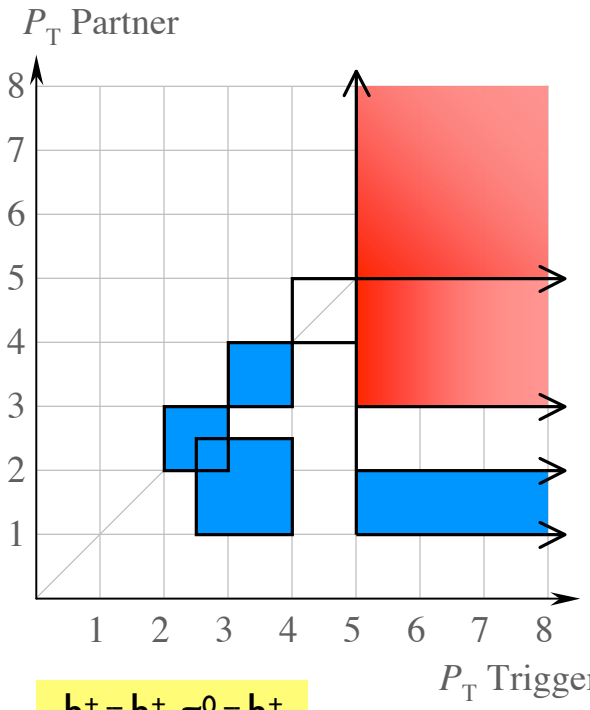
More central

h± − h± | C: Various | T: Various | P: Various



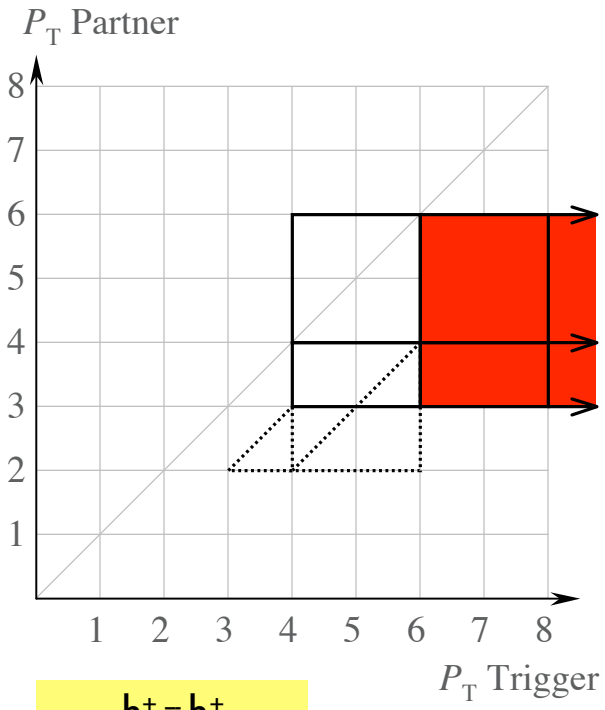
$h^{\pm} - h^{\pm}\ \pi^0 - h^{\pm}$

C: 20-40%



$h^{\pm} - h^{\pm}\ \pi^0 - h^{\pm}$

C: 0-20%



$h^{\pm} - h^{\pm}$

C: 0-5%

PWS ***opinions*** based on PHENIX Preliminary
and on PHENIX nucl-ex/0507004 submitted to PRL

STAR PRL 90, 082302 (2003)

STAR nucl-ex/0604018 Subm.

Summary

1. Away-side jet partners shows **three behaviors** in Au+Au:

   Complete disappearance at moderate $P_{T\ Trig}$ $P_{T\ Partner}$

   "Shoulder" peaks away from $\Delta\phi=\pi$ for low $P_{T\ Partner}$

   Normal shape, reduced magnitude at high $P_{T\ Trig}$ $P_{partner}$

2. Shoulder peak shape similar in-plane and out-of-plane

3. Results for $h^{\pm}$-$h^{\pm}$ confirmed in π^0-$h^{\pm}$ measurements

4. PHENIX also has preliminary results in Cu+Cu, and for $\gamma_{Inclusive}$-$h^{\pm}$ correlations (not shown here); we are working on γ_{Direct}-$h^{\pm}$ through several methods.